

CALiPER

Integrated LED Lamps

Testing Results: A Sampling of Products from Major Retailers

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SSL Market Introduction

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- What's really out there for consumers to purchase?
- CALiPER Retail Replacement Lamp Special Reports
 - Anonymous purchases
 - Omnidirectional, directional, and decorative lamps
 - Wide variety of manufacturers and retailers
 - LM-79 photometric testing (sphere only) conducted on three samples of each lamp



- **Products purchased July & August 2010**
- **Large disparities between high performing and low performing products**
 - Most of the lamps failed to meet basic performance parameters for use as replacements for incandescent or halogen lamps
- **Wide differences among retailers**
 - Most carrying (at least some) very low quality products
- **Differences among manufacturers**
 - Some consistent, some very inconsistent in performance across different products

Retail Replacement Lamps, Take Two!



MR16

PAR20

PAR30

A19

G25

38 Total Products.

9 Different Retailers.

18 Different Manufacturers.

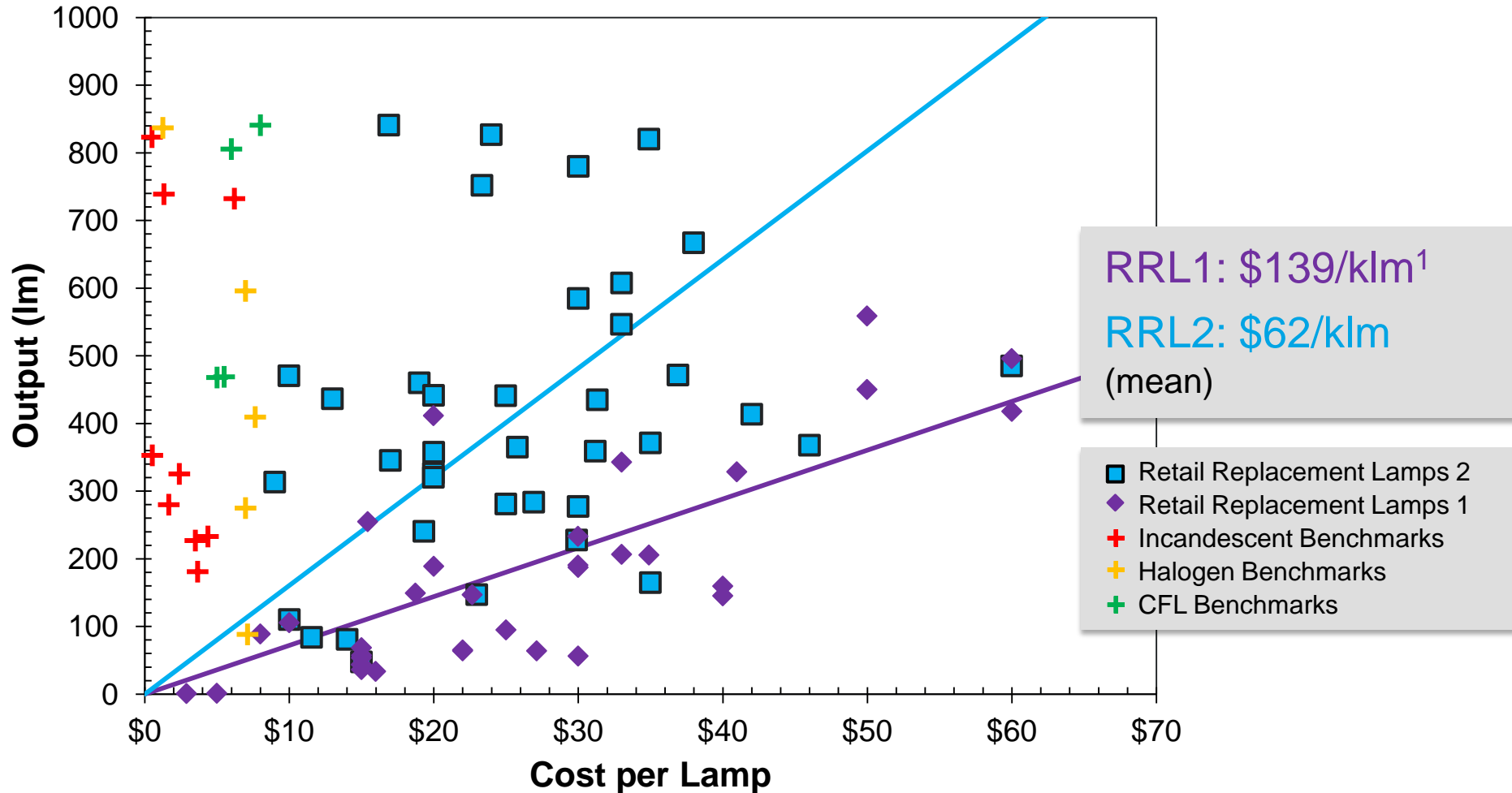
Note: Images do not necessarily represent products tested.

Retail Replacement Lamp Testing

	Round 1 (RRL1)		Round 2 (RRL2)	
Purchase Dates:	July & August 2010		November 2011	
Total Products:	33		38	
Product Types:	MR16/PAR16 ¹	11	MR16/PAR16 (120 V)	9
(nominal)	PAR20/R20	4	PAR20/R20	5
	PAR30/R30	7	PAR30/R30	8
	A19	5	A19	11
	B10 (Candelabra)	4	G25	5
	C7 (Nightlight)	2		
Retailers:	Ace Hardware BJ's Home Depot Lowe's Target Walmart Sam's Club Sears		Ace Hardware BJ's Home Depot Lowe's Target Walmart Amazon Costco Menard's	

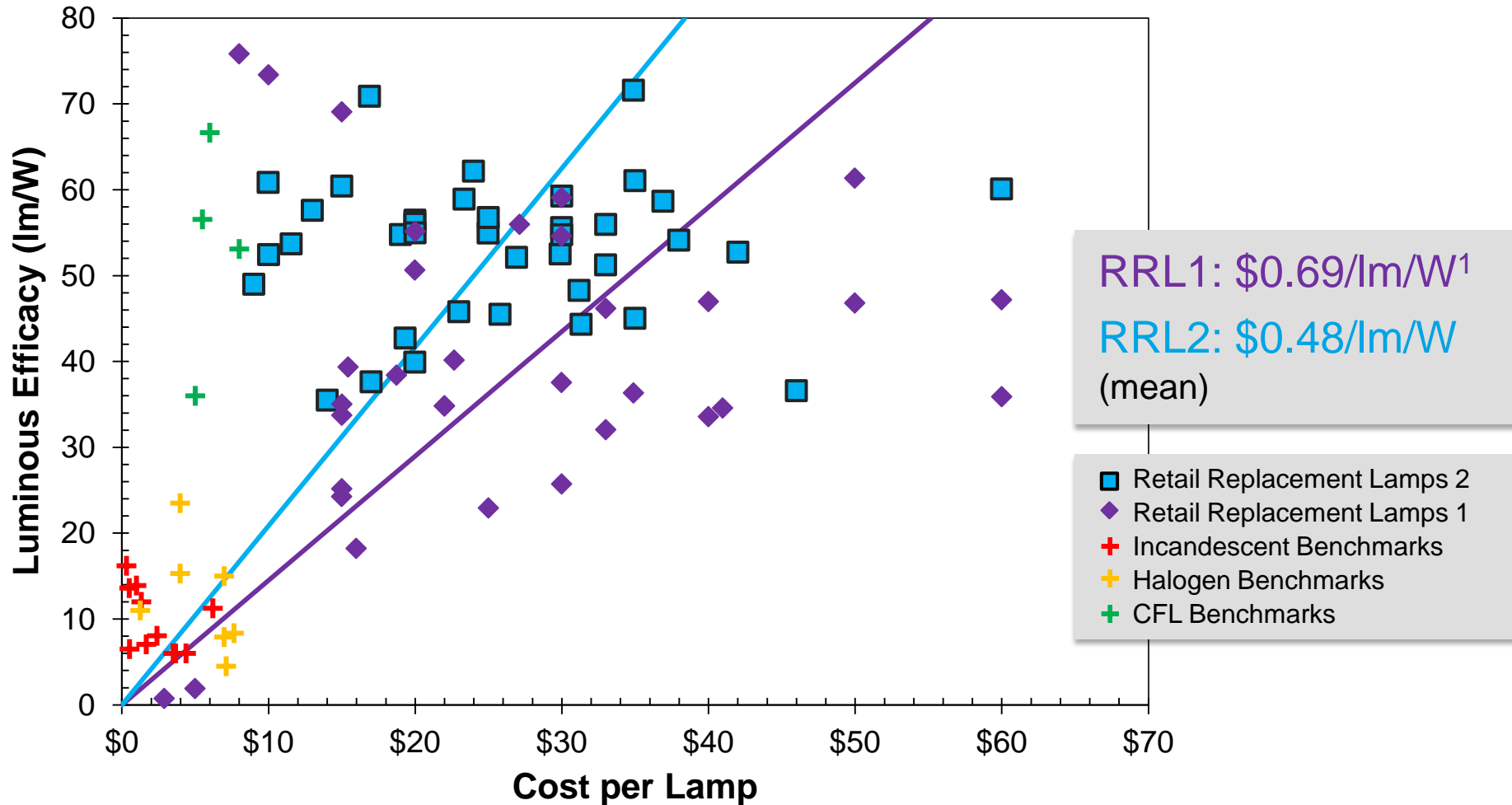
1. Products operated at different voltages.

Bang for the Buck? Lumen Output



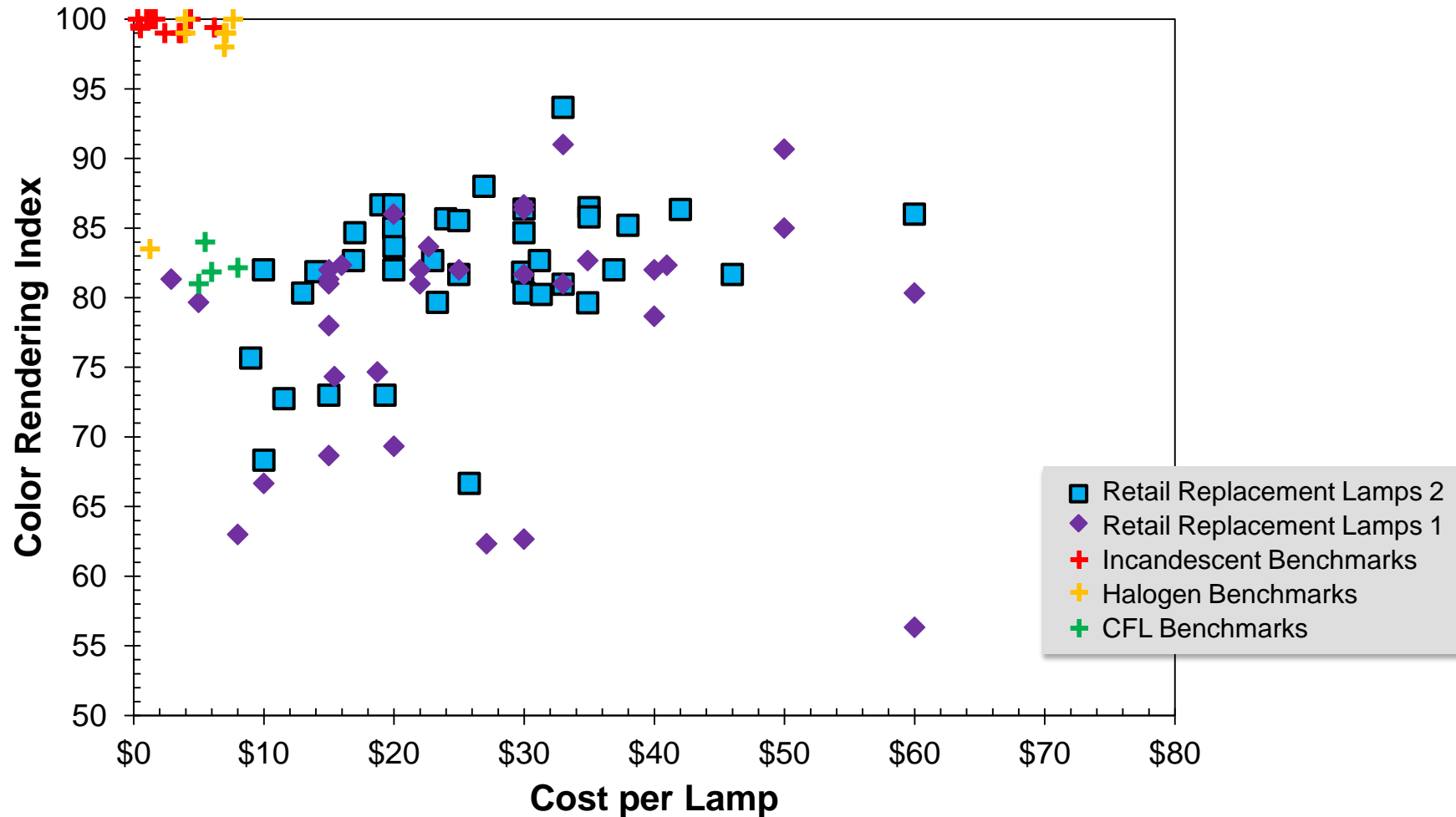
1. Includes only products of the same types tested in RRL2.

Bang for the Buck? Luminous Efficacy

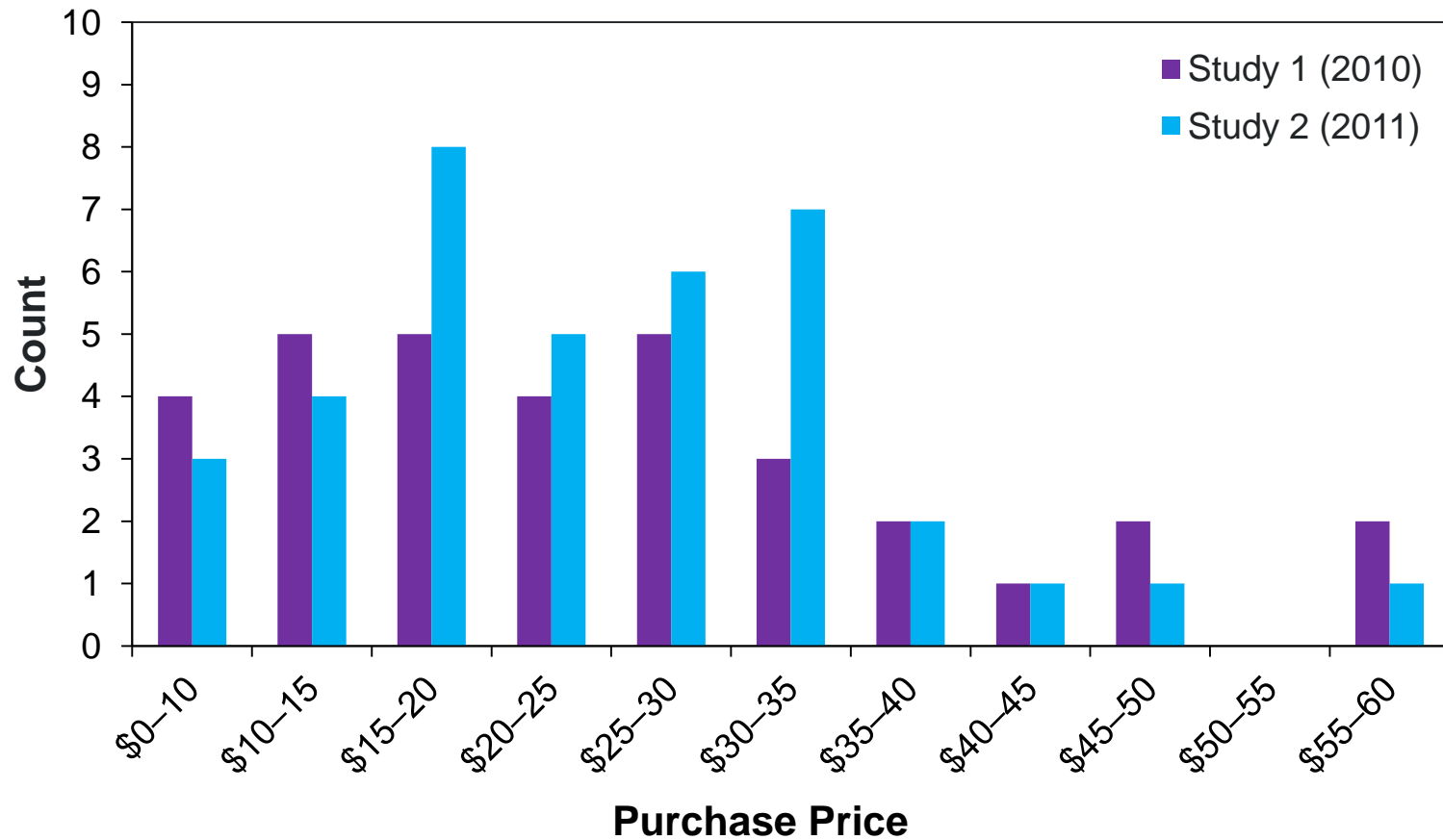


1. Includes only products of the same types tested in RRL2.

Bang for the Buck? Color Rendition



Bang for the Buck? Price Breakdown



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- Rounds 2–13 (2007–2011)
- RRL1 (2010)
- Anonymous purchases, LM-79 testing

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▪ LED Lighting Facts

- Data downloaded January 16, 2012
- Manufacturer-supplied LM-79 data
- Recommended performance levels

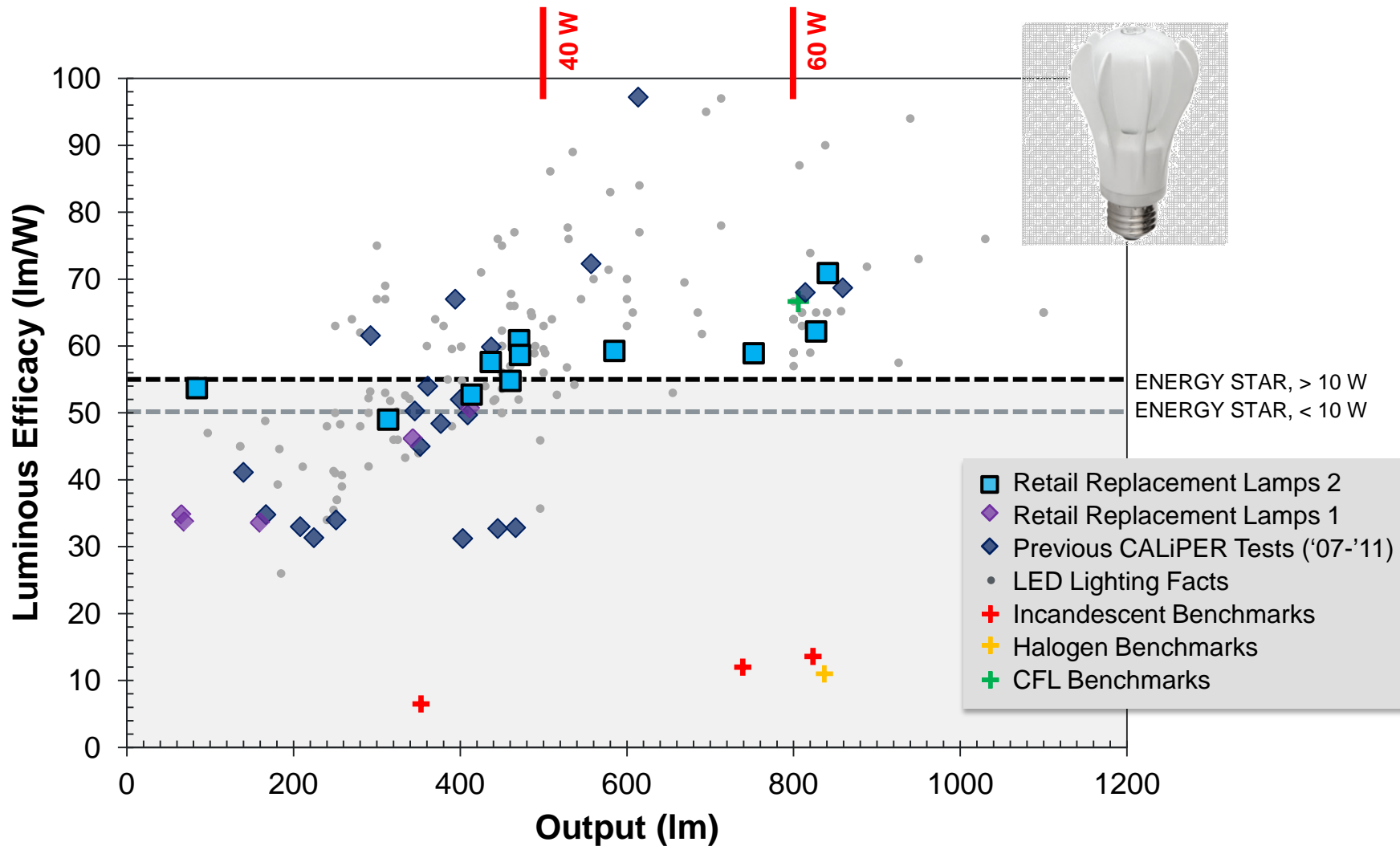


▪ ENERGY STAR®

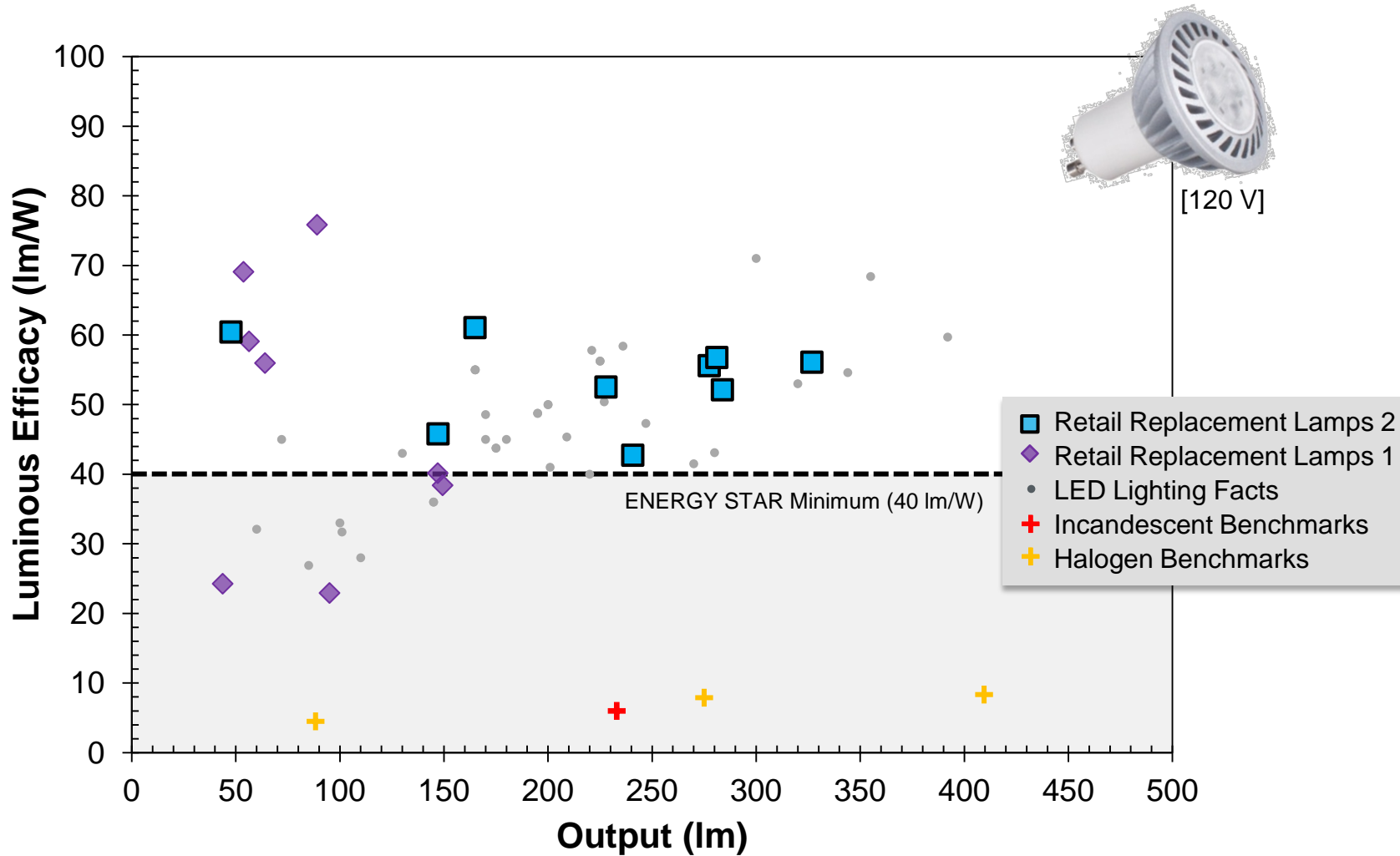
- Integral LED Lamps Version 1.4
- Some requirements vary by lamp type
 - Omnidirectional, Directional, Decorative, etc.



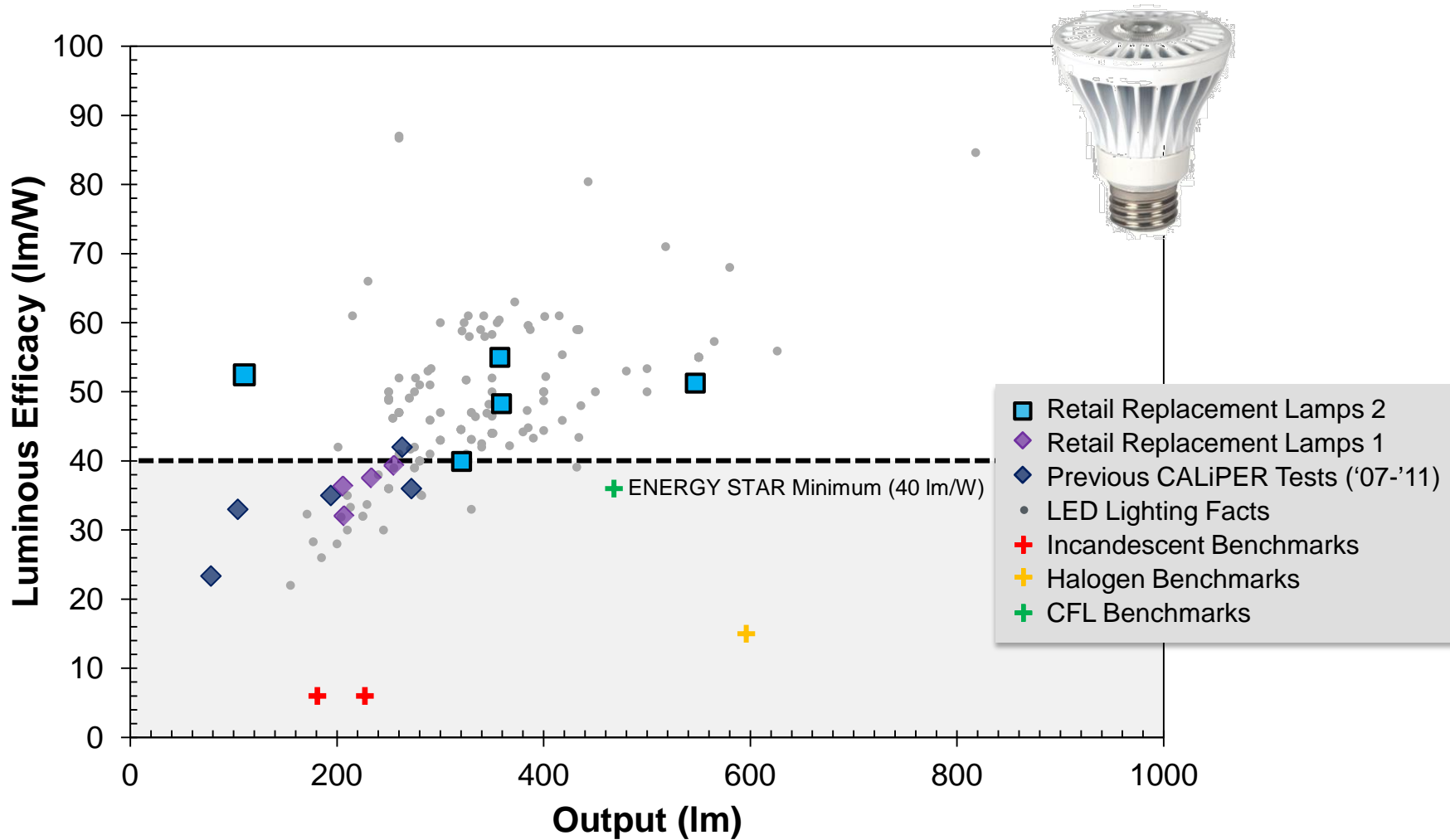
Performance vs. Benchmarks: A Lamps



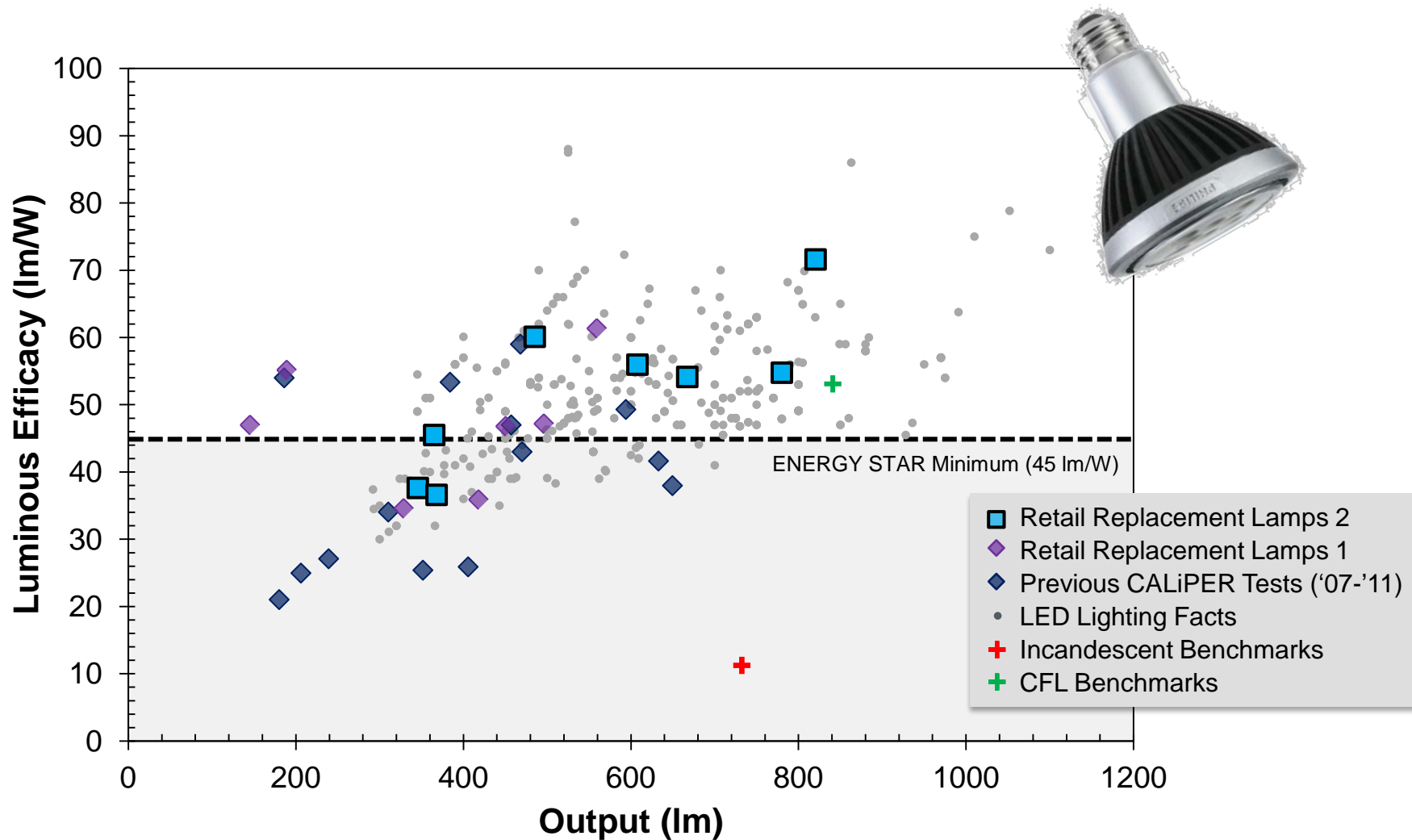
Performance vs. Benchmarks: MR16 Lamps



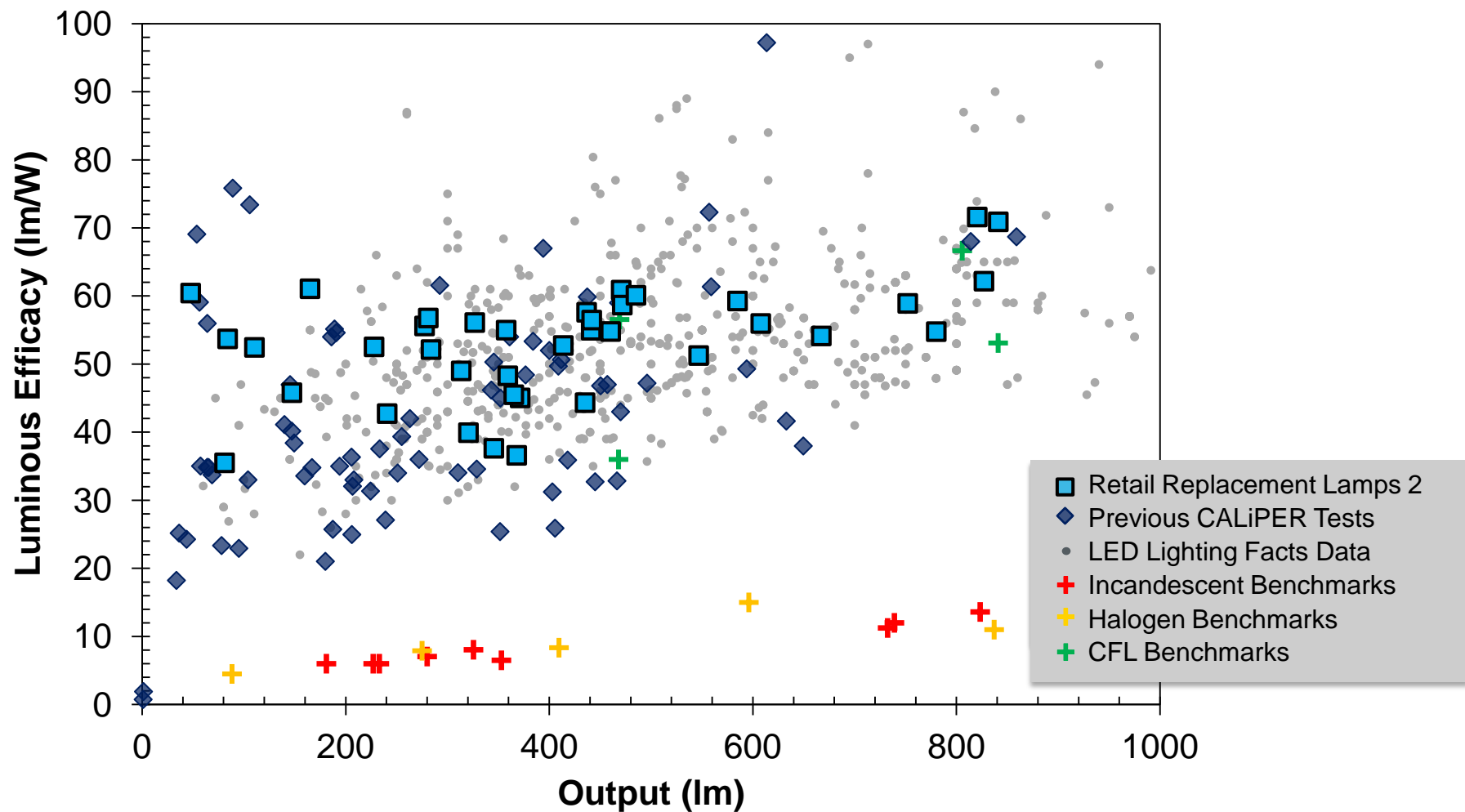
Performance vs. Benchmarks: PAR20 Lamps



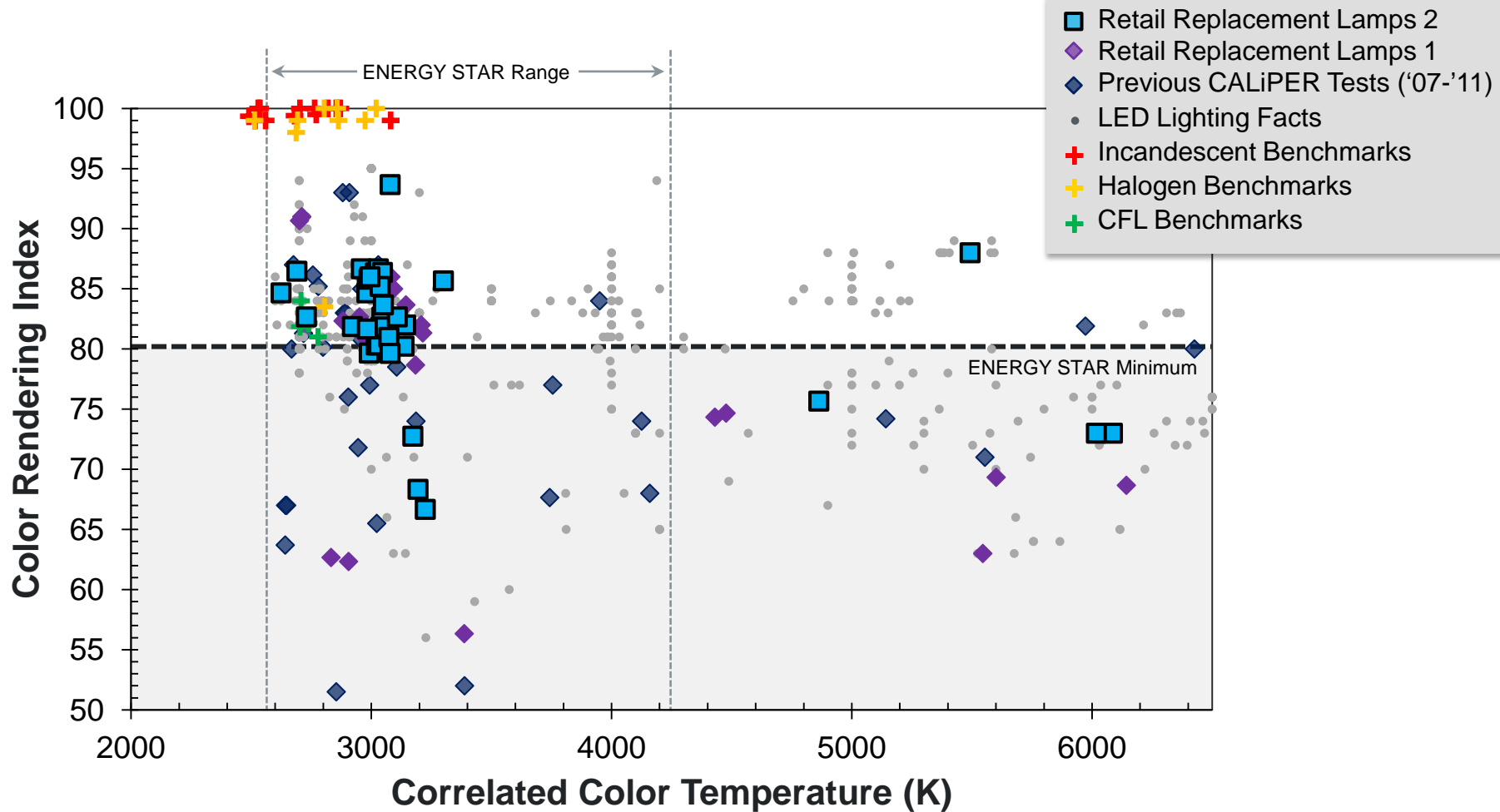
Performance vs. Benchmarks: PAR30 Lamps



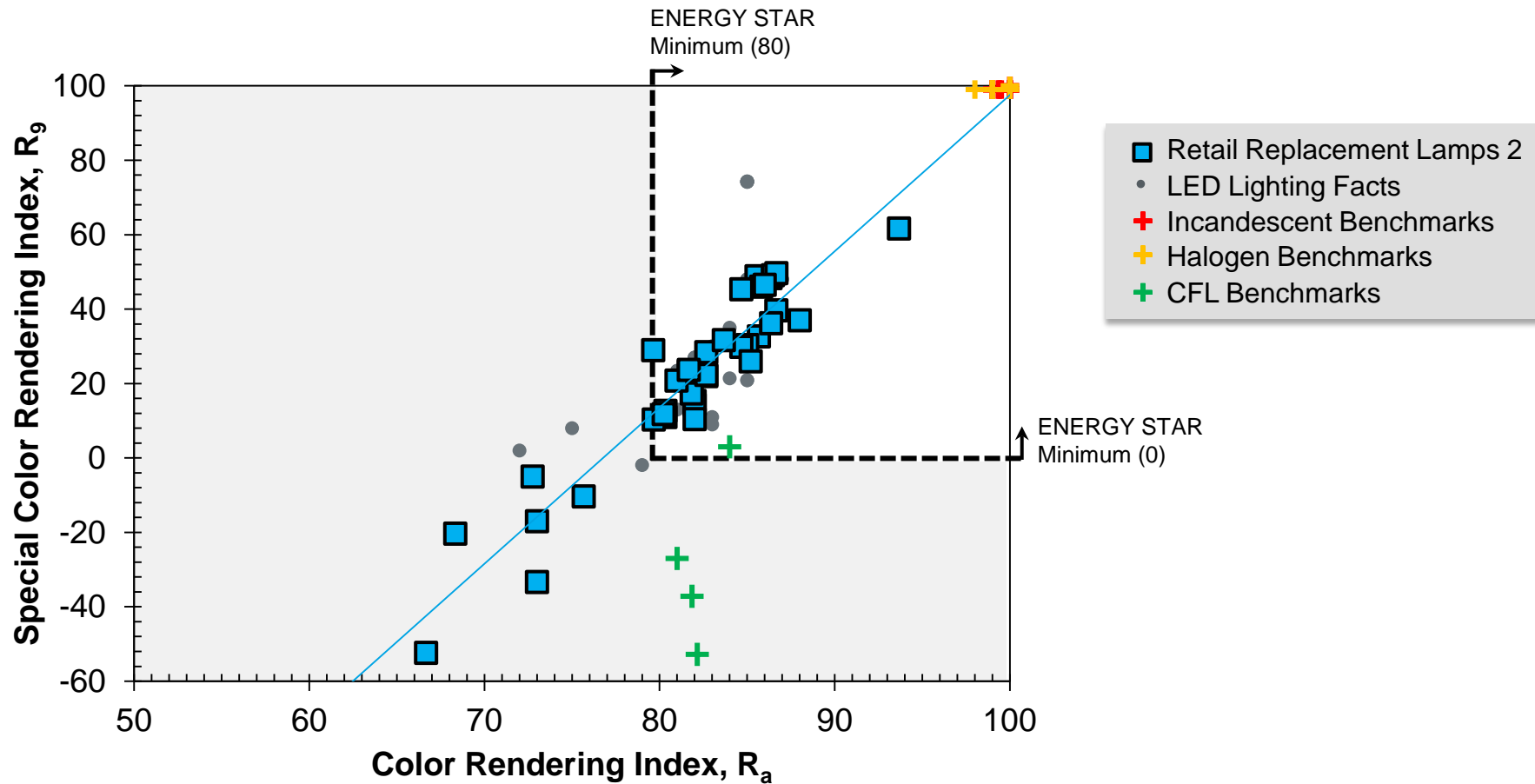
Performance vs. Benchmarks: All



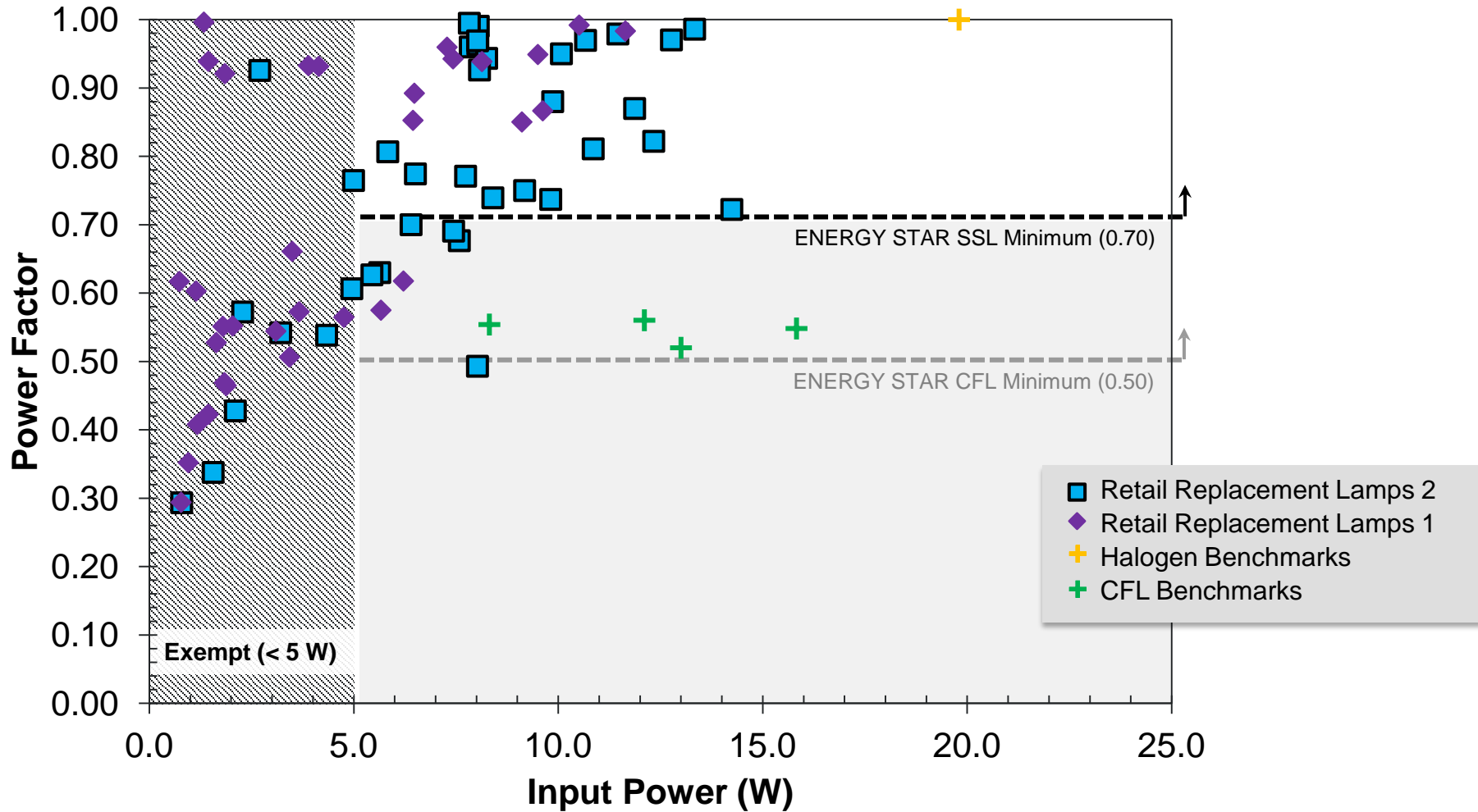
Performance vs. Benchmarks: Color Quality



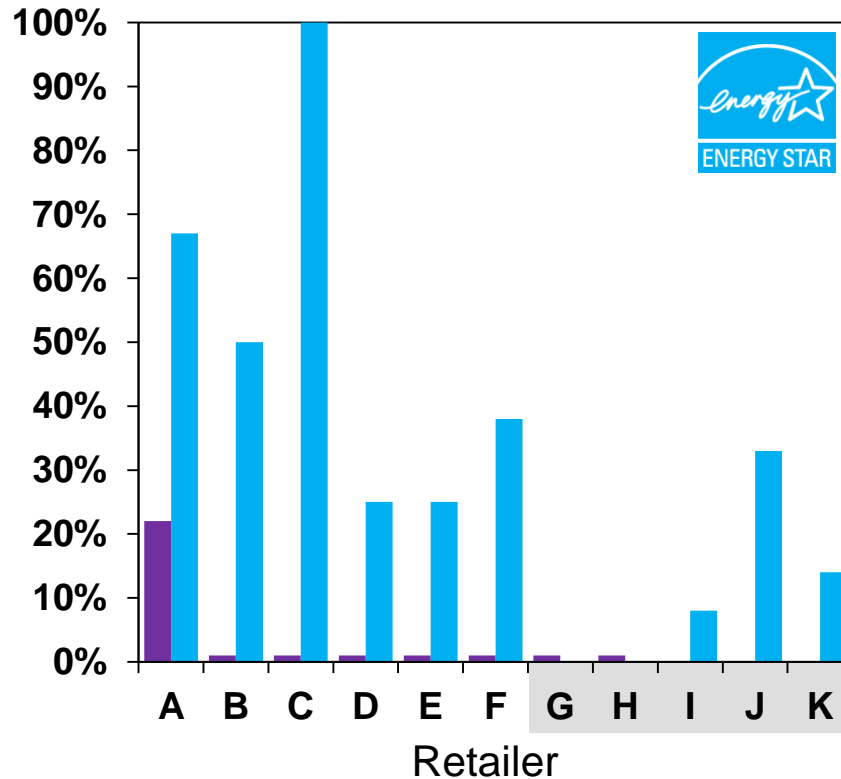
Performance vs. Benchmarks: Color Quality



Performance vs. Benchmarks: Electrical

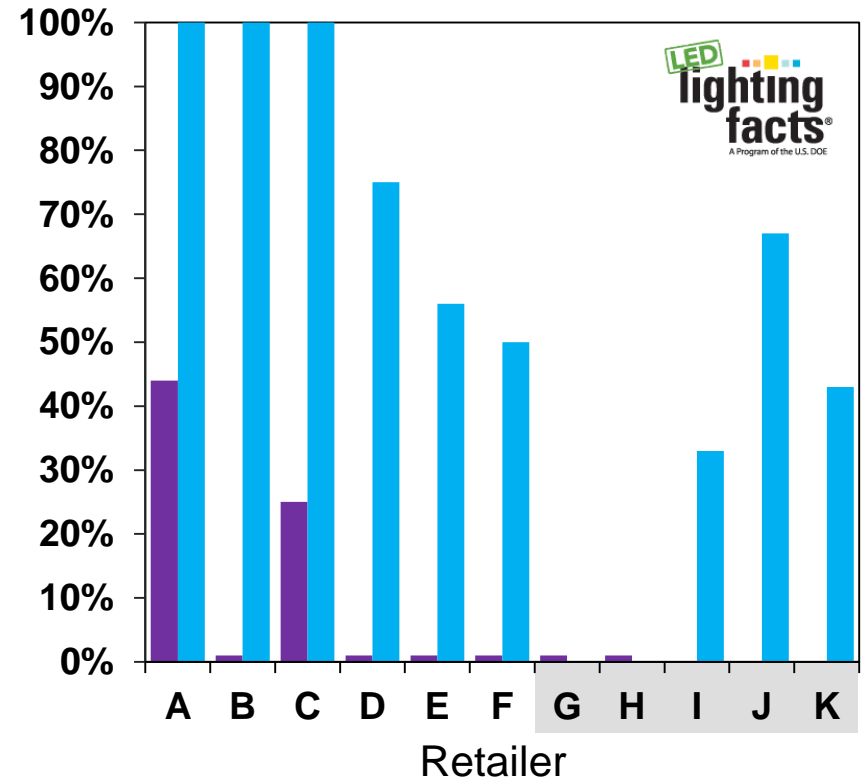


Product Labeling: Substantial Improvements



QTY RRL1: 9 5 4 2 5 3 3 2
QTY RRL2:¹ 6 4 2 4 9 8 12 3 7

RRL1: 6% RRL2: 15%

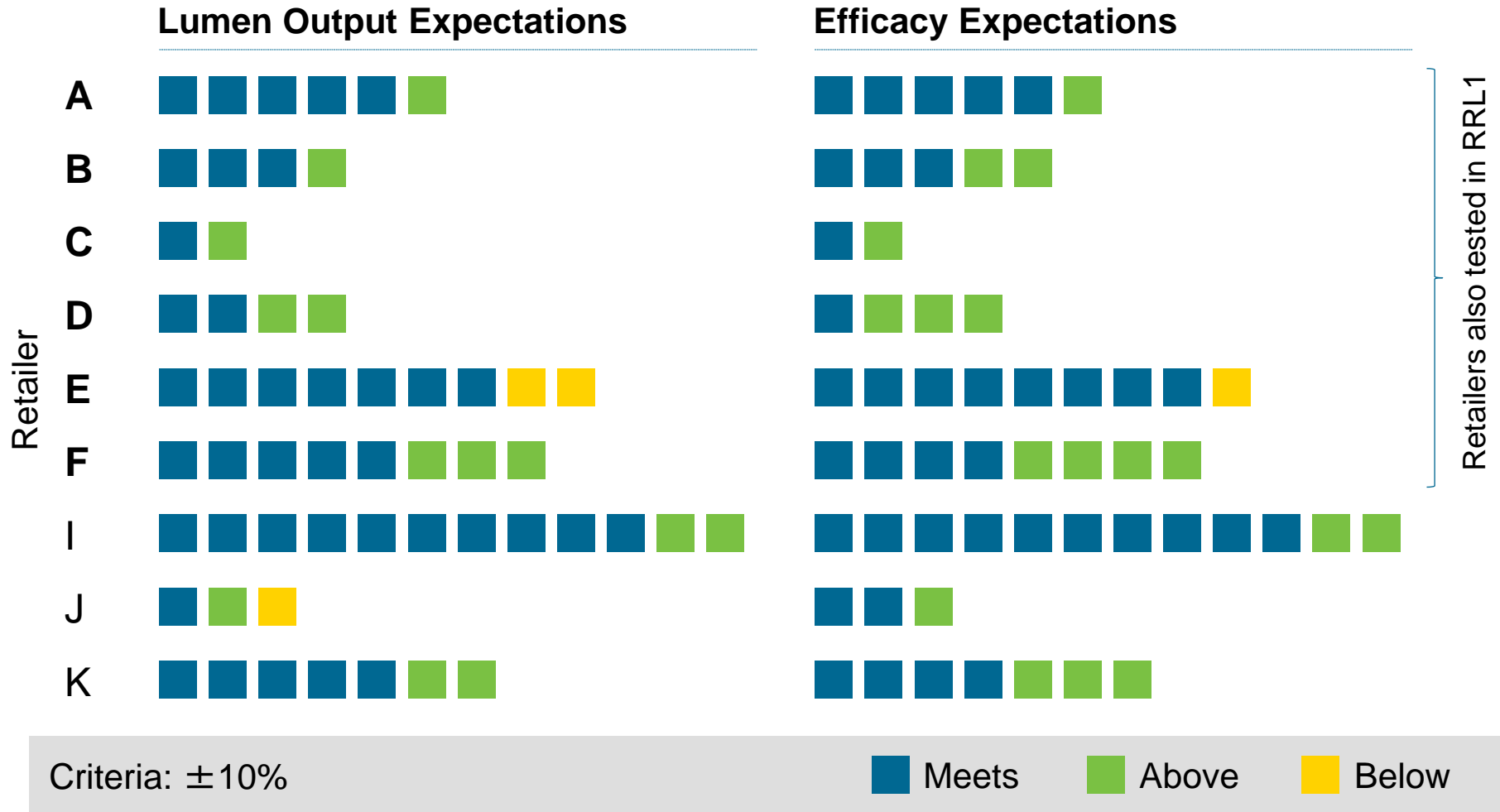


9 5 4 2 5 3 3 2
6 4 2 4 9 8 12 3 7

RRL1: 29% RRL2: 61%

1. Products listed for a retailer include any sold at the store that were tested as part of RRL2, regardless of purchase location.

Retailers: Is Listed Performance Accurate?

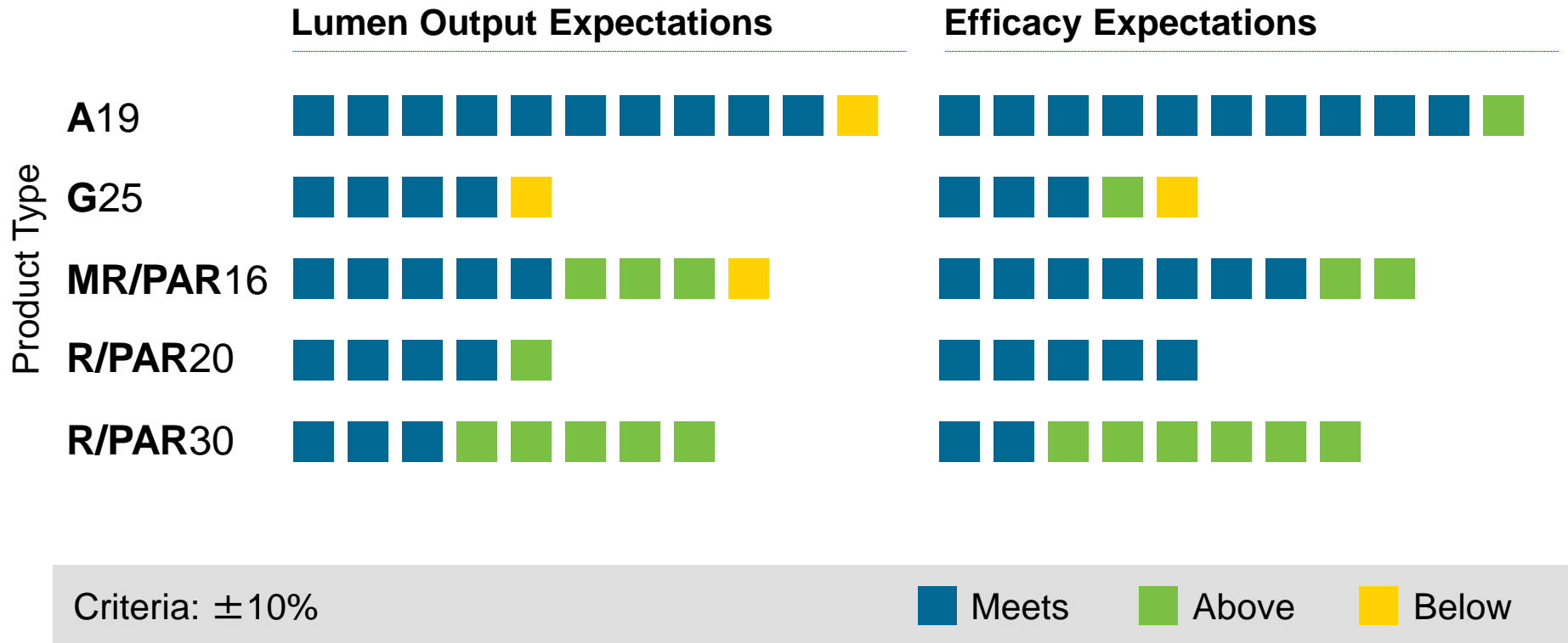


Note: Products listed for a retailer include any sold at the store that were tested as part of RRL2, regardless of purchase location.

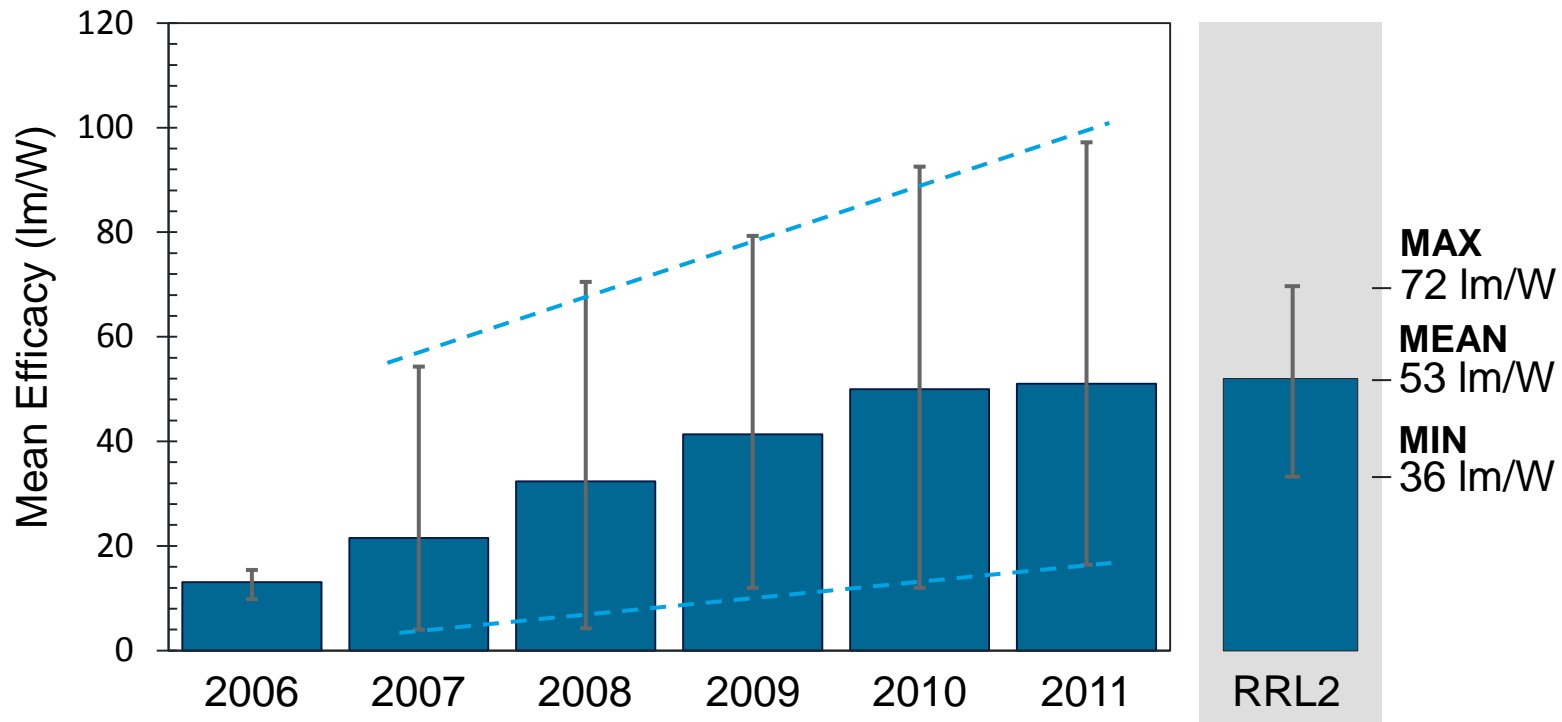
Manufacturers: Is Listed Performance Accurate?



Product Type: Is Listed Performance Accurate?



- **Range of efficacies continues to be wide, and getting wider**
 - Range partly due to numerous product types, with different requirements
 - Maximum efficacy continues to rise year by year
 - Smaller range for replacement lamps, but similar average

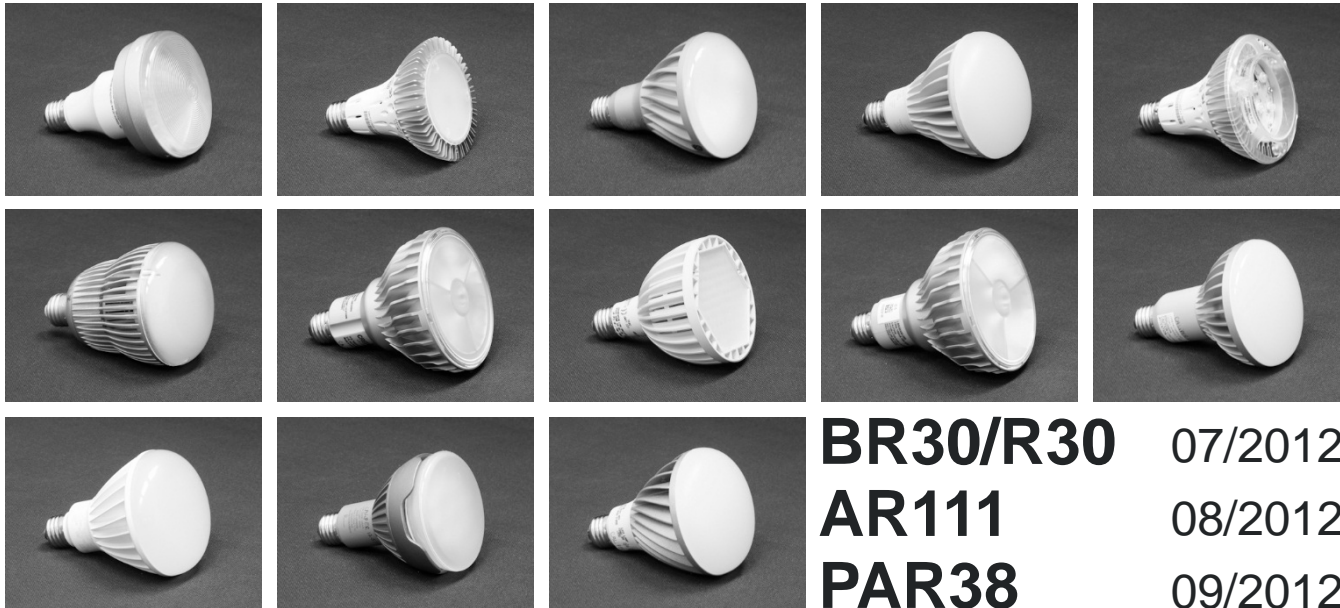


- **Overall performance generally much improved**
 - Higher lumen output and efficacy
 - Products reach higher lumen output milestones
 - Better color rendering
- **Substantial increase in performance per dollar**
 - Cost still higher than incandescent or CFL
- **Increased prevalence of product labels**
- **Some products still outside ANSI tolerances**
- **Better at meeting manufacturer data**
- **Equivalency claims not always met, although problems less frequent**
- **There are still some products that would not make good replacements for conventional lamps—careful evaluation is important!**

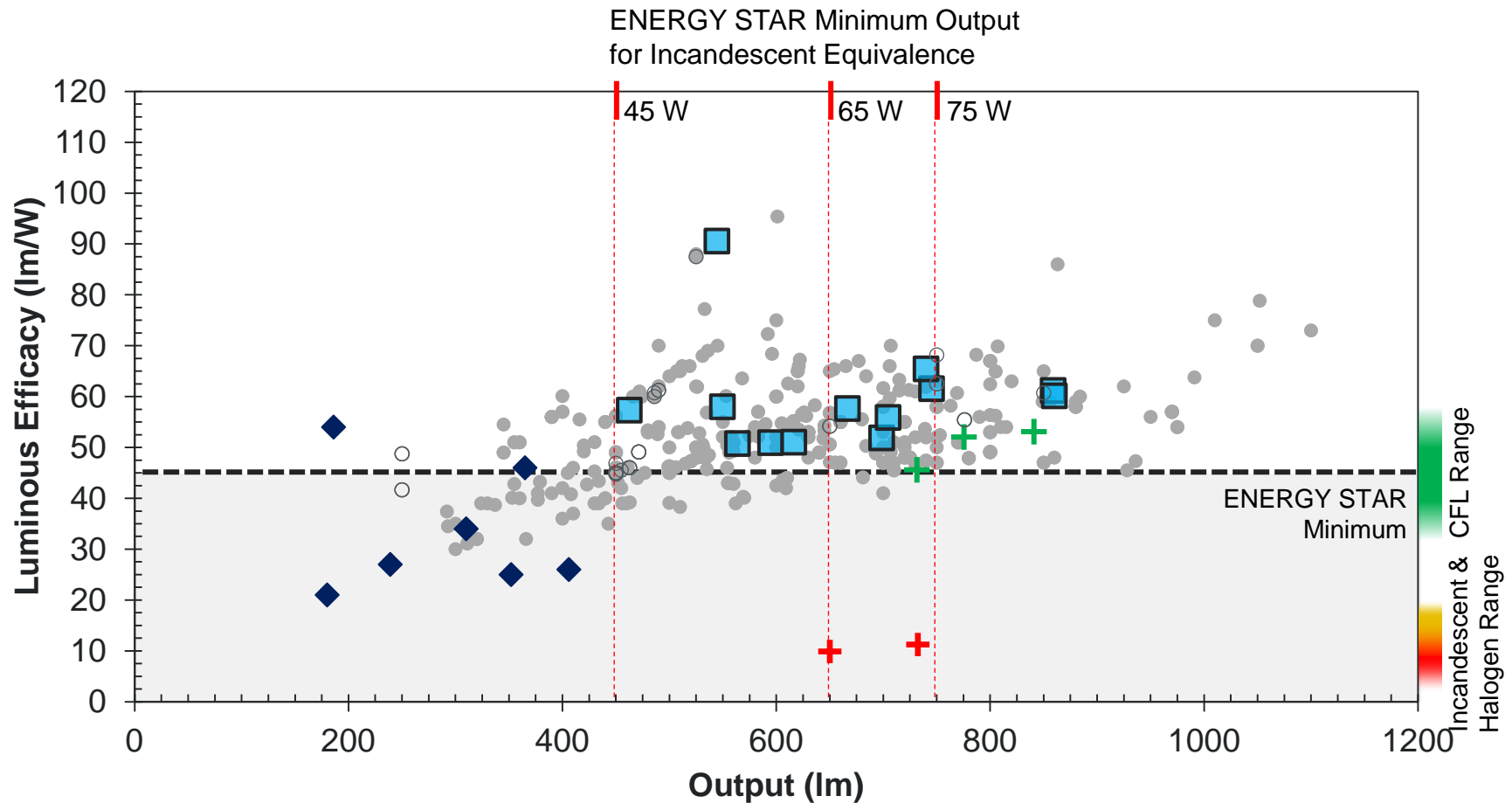
CALiPER LED Lamp Testing

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LED BR30/R30 Results (Available Now)



- Series 16 LED BR30/R30 Lamps (2012)
- Previously Tested LED BR30/R30 Lamps (2007-2011)
- LED Lighting Facts Data (May 2012)
- ENERGY STAR Data for Qualified LED Products (May 2012)
- Incandescent Benchmarks
- CFL Benchmarks

DOE SSL

<http://www.ssl.energy.gov/>

CALIPER Webpage:

<http://www1.eere.energy.gov/buildings/ssl/caliper.html>